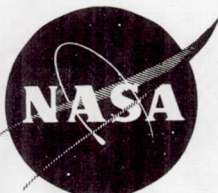


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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

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PROJECT: IMP-F
(To be launched no earlier
than May 24, 1967)

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NEWS



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WASHINGTON, D.C. 20546

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FIFTH IMP
MOST COMPLEX
IN SERIES

The most complex spacecraft in the Interplanetary Monitoring Platform (IMP) series of Explorer satellites is scheduled for launch by the National Aeronautics and Space Administration no earlier than May 24 from the Western Test Range, Lompoc, Calif.

Called the Interplanetary Monitoring Platform-F (IMP-F), the 163-pound spacecraft will be the fifth IMP launched. It is ten times more complex in design and has more experiments than any of the previous IMPs.

IMP-F carries 11 experiments. These will make measurements of solar and galactic cosmic rays within and at the boundary of the Earth's magnetosphere and in interplanetary space. The magnetosphere is an envelope formed by the Earth's magnetic fields which protects the Earth from radiation.

The basic purpose of the IMP series of spacecraft is to collect data for a study of Sun-Earth relationships. Particular emphasis is placed on how solar events influence the Earth's environment.

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Previous IMPs made such measurements during a period when activity on the Sun was at a minimum. IMP-F will continue and advance these measurements as the Sun's activity progresses towards its maximum phase over the next two years. Solar activity typically goes through an 11-year cycle which has an approximate two-year maximum phase followed by a nine-year period when activity declines to a minimum.

A three-stage improved Delta launch vehicle will be used to place the spin-stabilized IMP-F into orbit. Once in orbit, the spacecraft will be designated Explorer XXXIV. It is designed for an operational lifetime of one year.

IMP-F will be placed into an orbit which will carry the spacecraft out to 140,300 statute miles and as close as 161 statute miles to the Earth. The spacecraft will circle the globe once every four days. Inclination of the orbit to the equator will be 66.5 degrees.

Valuable scientific information about the Earth's magnetosphere has been obtained with scientific instruments carried aboard previous IMP spacecraft. Studies of the boundary or transition region between the Earth's magnetosphere and interplanetary space have been most significant.

Among the important discoveries made by previous IMP spacecraft during mapping missions of the magnetosphere on the Sun side of the Earth are:

- the Earth's magnetosphere is preceded by a shock wave;
- a turbulent region of highly energetic plasma exists between this shock wave and the magnetosphere boundary;
- the shock wave and the turbulent transition region trail back and away from Earth in increasingly widening bands.

Studies made possible with the IMP spacecraft complement the scientific objectives of the NASA Orbiting Geophysical Observatory (OGO) program. As such, they will contribute to the development of a solar flare prediction capability which will aid the NASA Apollo manned Moon landing program.

The IMP-F mission represents a cooperative effort between scientists from U.S. Universities, industry and government research facilities. These include the Goddard Space Flight Center, Greenbelt, Md.; the Universities of California, (Berkeley), Chicago, and Maryland, College Park; the University of Iowa, Iowa City; and the Southwest Center for Advanced Studies. Also included are the Bell Telephone Laboratories, Murray Hill, N.J., and TRW Systems Group, Redondo Beach, Calif.

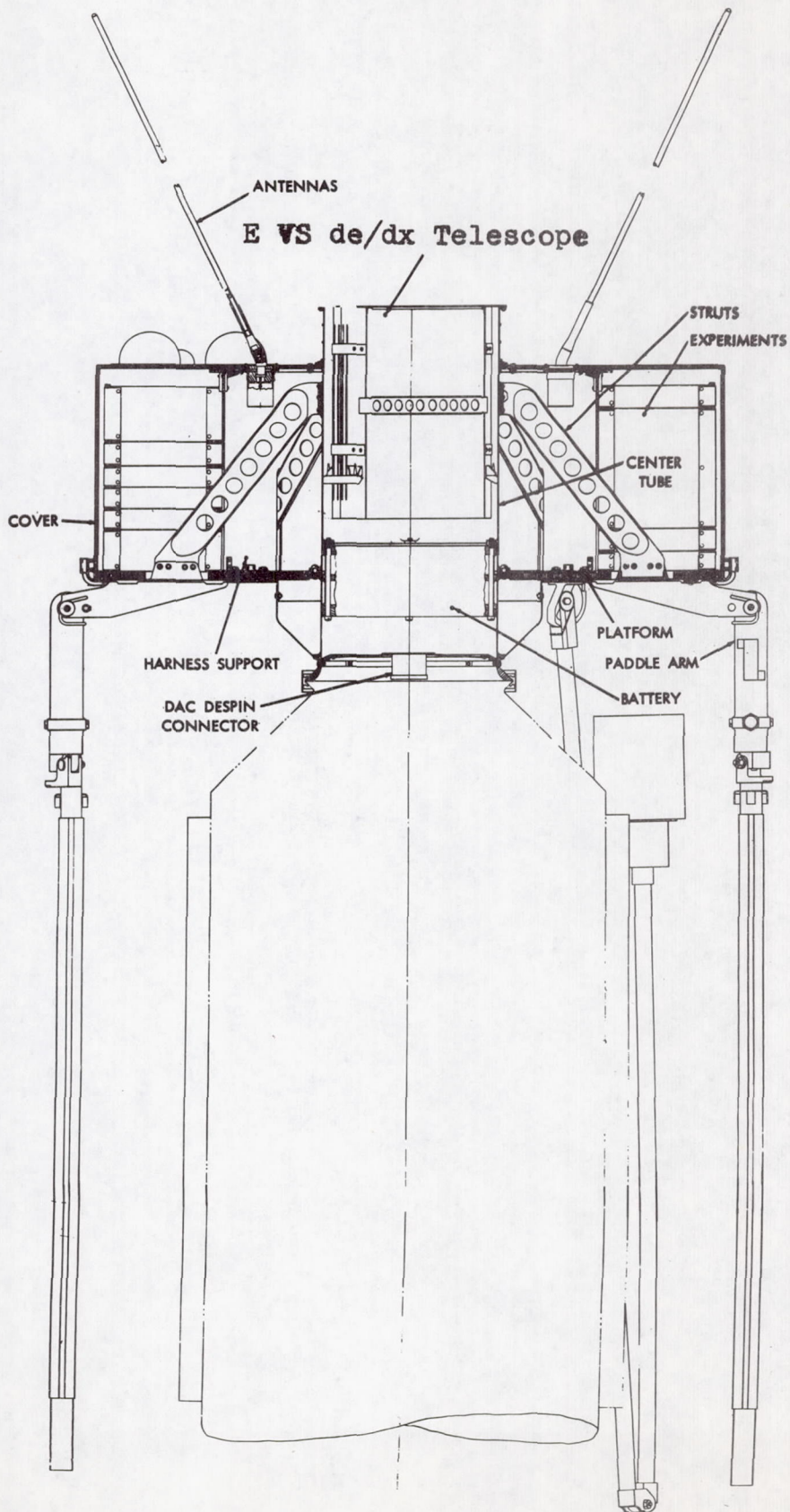
The IMP series is part of the space exploration program directed by NASA's Office of Space Science and Applications. NASA's Goddard Space Flight Center, manages the project. The spacecraft is designed, built and tested at Goddard.

-4-

Prime contractor for the three-stage Delta launch vehicle is the Douglas Aircraft Co. Inc., Santa Monica, Calif. The FW-4 motor is developed by United Technology Corp., Sunnyvale, Calif.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS)

-more-



THE IMP-F SATELLITE

The IMP-F is essentially a compact, unmanned physics laboratory weighing about 163 pounds. It is a spin-stabilized satellite, similar in design to the four previous spacecraft launched in the IMP series.

The basic structure of the IMP-F spacecraft is an octagon platform which measures 10 inches in height and about 28 inches in diameter. All but one of the experiments are carried inside this platform along with the spacecraft's electronics.

The remaining experiment, a fluxgate magnetometer, is carried on two fiberglass booms which extend out from the satellite base 180 degrees apart. These booms measure six feet long when extended in orbit.

Telemetry

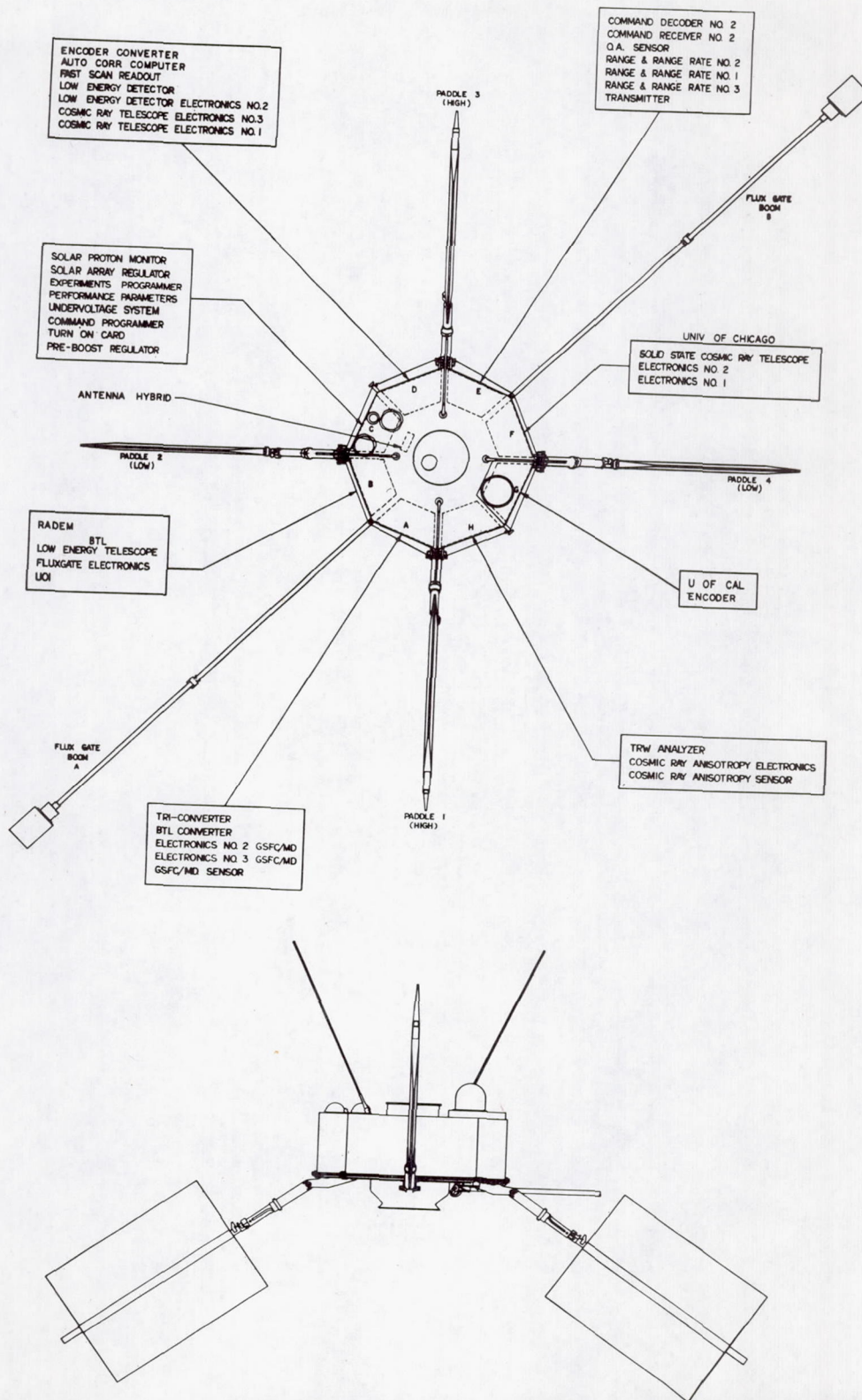
Data collected by the satellite's experiments are transmitted continuously. It is recorded by NASA's Space Tracking and Data Acquisition Network (STADAN). The telemetry transmitter onboard the IMP-F operates at a frequency of 136.14 megahertz, with a normal power output of four watts.

Four 16-inch telemetry antennas are affixed to the top of the spacecraft body about 90 degrees apart and extending outward at an angle of 45 degrees.

Power Supply

The IMP-F operates on solar power. The 6,144 solar cells carried on the spacecraft's four solar arrays convert the Sun's energy to supply a nominal average of 70 watts and a minimum of 47 watts after one year. About 15 watts of power are required to operate the experiments.

A vital part of the power package on this spacecraft is a battery pack which supplies power during periods of peak power demands and when the spacecraft is not in the sunlight. This pack contains 13 silver-cadmium batteries, each of which has a five ampere-hour storage capability. This is sufficient to operate the spacecraft for two hours without recharge.



EXPERIMENTS

Magnetic Field Experiment

The IMP-F carries a three-axis fluxgate magnetometer, the basic device for measuring magnetic fields. It was provided by the Goddard Space Flight Center. The device is designed to measure the direction and magnitude as well as the fluctuations of the components of the interplanetary magnetic field, the Earth's magnetic tail field and the magnetic field of the Earth's magnetosphere.

This magnetometer is a dual-range device which is controlled by group command. A low range of this device measures the weaker magnetic fields farther out from the Earth and a higher range operates when the spacecraft is near the Earth where the fields are stronger. An integral part of this experiment is an auto-correlation computer housed in the spacecraft body. The fluxgate magnetometer weighs about three and a half pounds and uses about one and a half watts of power for operation.

Radiation Experiments

Two radiation monitoring experiments are carried by the IMP-F to extend the energy measurements already made by higher range experiments. They are designed to measure the intensity and energy spectrum of relatively low energy electrons and protons in interplanetary space and in the outer regions of the Earth's magnetosphere.

Data collected with these instruments will contribute to a better understanding of the interactions among particles, plasmas and fields as well as their collective sensitivity to the time varying conditions on the Sun.

1. Low Energy Telescope. (Bell Telephone Laboratories, Inc.) It consists of an array of solid state detectors designed to measure electrons and protons in the energy range of 500 kilo-electron volts to 10 milli-electron volts.

The low-energy telescope weighs about four pounds and requires about one and three quarters watts of power for operation.

2. Low Energy Proton and Electron Differential Energy Analyzer. (University of Iowa) It is a particle detector designed to measure the energy and directivity of electrons and protons in the energy range of 100 electron volts to 50 kilo-electron volts. This range permits the instrument to measure low energy particles from the Sun and in the magnetosphere as well as the solar wind.

A further purpose of this experiment is to make an extensive search for large-intensity, low-energy protons in the energy range of 10 to 100 kilo-electron volts at a distance from the Earth of 8,000 to 24,000 miles.

This device weighs about one and a half pounds and requires about one watt of power.

Galactic & Solar Cosmic Ray Experiments

Six experiments aboard the IMP-F are designed to measure both galactic and solar cosmic radiation. The composition, intensity and direction of this radiation will be measured by the following experiments:

1. Range Versus Energy Loss (University of Chicago) This experiment uses a solid state cosmic ray detector. It is designed to make definitive measurements of both galactic and solar cosmic ray particles when the Sun is most active.

It will continue the interplanetary and magnetospheric measurements conducted by similar cosmic ray experiments aboard the IMPs I, II and III. Weighing about nine and a quarter pounds, this experiment requires about two watts of power for operation.

2. Energy Versus Energy Loss (Goddard Space Flight Center) It is a solid state detector designed to make essentially the same measurements as the Range Versus Energy Loss experiment. This experiment weighs about eight and a quarter pounds and requires about two watts of power.

3. Low Energy Proton and Alpha Detector (Goddard Space Flight Center) It is designed to measure galactic and solar cosmic ray flux levels, particularly at low energies. Weight of this device is about one and a half pounds. It uses almost two watts of power.

4. Ion Chamber (University of California) This experiment serves as a basic monitor of solar cosmic rays. It is also sensitive to solar electron events. In addition it will provide further information on the description of energetic particle populations in and beyond the Earth's outer magnetosphere as well as the dynamic processes that influence these populations and their relation to the solar phenomena. Weighing about one and a half pounds, this experiment uses about one fifth of a watt of power.

5. Solar Proton Monitoring Experiment (Applied Physics Laboratory--Goddard Space Flight Center) This experiment is also a basic monitoring device for solar protons. It is a simple device designed to operate outside the Earth's magnetosphere and does not have to screen out a background flux of high energy electrons.

The experiment weighs about three and three-quarter pounds and operates on three quarters of a watt of power.

6. Cosmic Ray Anisotropy (Southwest Center for Advanced Studies) It is a combination solid state detector and a scintillation counter designed to measure the anisotropy or angular distribution of solar cosmic rays. Information from this experiment will contribute to a study of the large scale features of the interplanetary field. The experiment weighs about five and three quarters pounds and requires a little over one watt of power for operation.

Plasma Experiments

The IMP-F carries two experiments to measure the plasma (solar wind) in its orbit. These are:

1. Spherical Electrostatic Analyzer (TRW Systems) Designed to obtain a detailed energy spectrum of the solar wind in interplanetary space, it will also search for particles arriving from directions other than that of the Sun. Yet another function of this instrument will be to measure the directional properties of the solar wind. Weighing about three pounds, this experiment requires one and three quarters watts of power for operation.

2. Plasma Experiment (Goddard Space Flight Center--University of Maryland) It is designed to determine the composition and energy distribution of hydrogen and helium ions in the solar wind and in the transition zone between the wind and the Earth's magnetosphere. The plasma experiment weighs about five pounds and operates on a little over three watts of power.

PREVIOUS IMP SCIENTIFIC FINDINGS

The scientific community has obtained valuable information about the Earth's magnetosphere with experiments carried aboard previous IMP spacecraft. Studies of the boundary or transition region between the Earth's magnetosphere and interplanetary space have been most significant.

Spacecraft in the IMP series pioneered in the mapping of the magnetosphere on the Sun side of the Earth. Among the important contributions made thus far was the discovery of a shock wave preceding the Earth's magnetosphere. This wave, similar to that created by a supersonic aircraft, is caused by the solar wind. A turbulent region of highly energetic plasma between the shock

wave and the magnetosphere boundary also was discovered.

Detailed mapping of the Earth's magnetic field on the night-time side of the Earth has revealed the development of a significant magnetic tail which does not co-rotate with the Earth. Located within this tail is a large sheet-like magnetically neutral surface which is caused by lines of force oppositely directed. These lines are inferred to be directly connected to the polar cap regions. The neutral sheet is populated with energetic electrons which may be the source of radiation leading to the auroral displays (northern lights) and the Van Allen radiation belts.

While these discoveries have been the most significant new findings of the earlier IMP spacecraft, further studies of the strength, velocity and changes in solar wind plus new insights into the intensity and time variations of cosmic rays also have been of more than routine scientific interest.

The first IMP spacecraft, Explorer XVIII, was launched from Cape Kennedy Nov. 23, 1963. More than 5,600 hours of scientific data were provided by this spacecraft before its transmissions became intermittent in May of 1964.

The second IMP, Explorer XXI, was launched from Cape Kennedy Oct. 3, 1964. Although short of its planned orbit, this spacecraft provided added data on the magnetosphere. In all, about five months of useful data was recorded. There is some possibility that perhaps as much as a month's more data might be obtained from this spacecraft in the future.

Explorer XXVIII, the third IMP, was launched from Cape Kennedy May 29, 1965, into a normal orbit. This spacecraft is still transmitting useful scientific data.

THE DELTA LAUNCH VEHICLE

NASA's improved Delta launch vehicle will be used to boost the IMP-F into orbit. This vehicle includes a thrust-augmented Thor first stage, the enlarged Delta second stage, and the FW-4 third stage.

Project management of the Delta launch vehicle is vested in the Goddard Space Flight Center. Prime contractor is the Douglas Aircraft Co., Santa Monica, Calif.

Delta Statistics

The three-stage Delta for the IMP-F mission has the following characteristics:

Height: 92 feet (includes shroud)
Maximum Diameter: 8 feet (without attached solids)
Liftoff Weight: about 75 tons
Liftoff Thrust: 333,820 pounds (including strap-on solids)

First stage (liquid only): Modified Air Force Thor, produced by Douglas Aircraft Co., engines produced by Rocketdyne Division of North American Aviation.

Diameter: 8 feet
Height: 51 feet
Propellants: RP-1 kerosene is used as the fuel and liquid oxygen (LOX) is utilized as the oxidizer.
Thrust: 172,000 pounds
Weight: Approximately 53 tons

Strap-on Solids: Three solid propellant Sergeant rockets produced by the Thiokol Chemical Corp.

Diameter: 31 inches
Height: 19.8 feet
Weight: 27,510 pounds (9,170 each)
Thrust: 161,820 pounds (53,940 each)

Second Stage: Produced by the Douglas Aircraft Co., utilizing the Aerojet-General Corp. AJ110-118 propulsion systems major contractors for the auto-pilot include Minneapolis-Honeywell, Inc., Texas Instruments, Inc., and Electrosolids Corp.

Propellants: Liquid -- Unsymmetrical Dimethyl Hydrazine (UDMH) for the fuel and Inhibited Red Fuming Nitric Acid (IRFNA) for the oxidizer.

Diameter: 4.7 feet (compared to 2.7 feet for the earlier
Deltas)
Height: 16 feet
Weight: $6\frac{1}{2}$ tons (compared to $2\frac{1}{2}$ tons for the earlier Deltas)
Thrust: about 7,800 pounds
Guidance: Western Electric Co.

Third Stage: United Technology Corp., FW-4.

Thrust: 5,450 pounds
Fuel: solid propellant
Weight: about 660 pounds
Length: about 62 inches
Diameter: 19.6 inches

IMP-F PROJECT OFFICIALS, EXPERIMENTERS,
AND MAJOR CONTRACTORS

NASA Headquarters

Dr. Homer E. Newell, Associate Administrator for Space
Science and Applications.

Jesse L. Mitchell, Director, Physics and Astronomy Programs.

Frank W. Gaetano, Associate Program Manager.

Dr. A. Schardt, Program Scientist.

R. Manville, Delta Program Manager.

Goddard Space Flight Center

Paul Butler, Project Manager.

Benjamin H. Ferer, Assistant Project Manager.

Dr. Frank B. McDonald, Project Scientist.

William R. Limberis, Project Coordinator.

Curtis M. Stout, Tracking and Data Scientist.

William B. Schindler, Delta Project Manager.

Kennedy Space Center/Western Test Range

Robert H. Gray, Assistant Director, Unmanned Launch
Operations, Kennedy Space Center.

Experimenters

Dr. W. L. Brown, Bell Telephone Laboratories, Inc.,
Low Energy Telescope.

Dr. K. A. Anderson, University of California (Berkeley),
Ion Chamber.

Dr. J. A. Simpson, University of Chicago,
Range Versus Energy Loss.

J. A. Van Allen, University of Iowa,
Low Energy Proton and Electron Differential Energy Analyzer.

Dr. K. G. McCracken, Graduate Research Center of the
Southwest,
Cosmic Ray Anisotropy.

Dr. F. B. Harrison, TRW Systems,
Spherical Electrostatic Analyzer.

Dr. Carl Bostrom, Goddard Space Flight Center,
Solar Proton Monitoring Experiment.

Dr. K. W. Ogilvie, Goddard Space Flight Center, and
Dr. T. D. Wilkerson, University of Maryland,
Plasma Experiment.

Dr. Frank B. McDonald, Goddard Space Flight Center,
Low Energy Proton and Alpha Detector.

Dr. Frank B. McDonald, Goddard Space Flight Center,
Energy Versus Energy Loss.

Dr. Norman F. Ness, Goddard Space Flight Center,
Magnetic Field Experiment.

Major Contractors

Electro-Mechanical Research, Inc., College Park, Md.
Spacecraft Integration.

Douglas Aircraft Co., Santa Monica, Calif.
Delta Rocket.

IMP-F FACT SHEET

Launch: 30-minute daily launch window from space launch complex 1, Pad 1, Western Test Range.

Launch Rocket: Thrust Augmented Delta (TAD).

Orbit: Apogee: 140,300 statute miles
Perigee: 161 statute miles
Period: four days
Inclination: $66\frac{1}{2}$ degrees

Design Lifetime: 12 months

Spacecraft Weight: 163 pounds, with about 51 pounds of experiments.

Main Structure: Octagon shape, 28 inches in diameter.

Appendages: Four rectangular-shaped solar panels.
Four transmitting antennas, 16 inches long.
Two hinged magnetometer booms about six feet long.

Power System: Power Supply: 6,144 solar cells mounted on four panels to supply minimum average power of 70 watts with one silver cadmium battery pack capable of supplying 45 watts of power for two hours.

Power requirements: 35 watts average.

Communications and Data-Handling System:

Telemetry: Pulsed-frequency modulation (PFM).
Transmitter: Four watt output at a frequency of 136.140 mc.
Encoder: PFM with digital data processor (DDP) for accumulation and storage of data.

Tracking and Data-Acquisition Stations: Space Tracking and Data Acquisition Network (STADAN) operated by Goddard Space Flight Center with primary stations located at:

Data Acquisition: Santiago, Chile.
Tananarive, Malagasy.

Tracking: Kano, Nigeria.
Tananarive, Malagasy.
Johannesburg, Republic of South Africa.
Santiago, Chile.
Orroral, Australia.
Rosman, N.C.
Fairbanks, Alaska.